2824

03500.015727. PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

TAKEO TSUKAMOTO

Application No.: 09/941,780

Filed: August 30, 2001

For: ELECTRON-EMITTING DEVICE, ELECTRON -EMITTING APPARATUS, IMAGE DISPLAY APPARATUS, AND LIGHT- EMITTING APPARATUS

Examiner: D. H. Vu

Group Art Unit: 2821

November 4, 2004

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

In compliance with the duty of disclosure under 37 C.F.R. § 1.56 and in accordance with the practice under 37 C.F.R. §§ 1.97 and 1.98, the Examiner's attention is directed to the documents listed on the enclosed Form PTO-1449. Copies of the documents listed and a copy of a Japanese Official Letter citing these documents are enclosed. At least a partial English translation of the Japanese Official Letter also is enclosed. The Japanese Official Letter was issued in a foreign counterpart application.

Document JP11-194134, which is cited in the Japanese Official Letter, is not listed on the Form PTO-1449, because that document is already of record. However, a further copy of that document is submitted herewith merely for the Examiner's convenience in interpreting the Japanese Official Letter, which, as pointed out below, cites particular portions of the document.

Applicant represents that the Japanese Official Letter states, in a section that has been marked ① for the Examiner's convenience, the following:

*①

Reason 2

The present invention as defined in claims of the present application is identical with those disclosed in the following documents.

Cited References
Prior Application 1: JP Application 11-118462 (JP Publication 2000-277003)
Prior Application 2: JP Application 11-220445 (JP Publication 2001-052598)

Claims 21, 22-27, 30-39 are identical with inventions disclosed in (claims of) the above Prior Applications 1 and 2.

Prior Application 1 (2000-277003) discloses in particular paragraphs [0041] - [0042] [see label *③ inserted for the Examiner's convenience] an electron-emitting device wherein a carbon nanotube is disposed on a plane of a cathode, and a catalyst such as Pd, Ni, Fe, Co and etc. is used to form the carbon nanotube, and an electron emitting display using the electron emitting devices. And, the carbon nanotube consists of a single or plural graphens is well-known. Accordingly, the present invention as defined in claims 21, 23-27, 30-39 is substantially identical with the technique as disclosed in the Prior Application 1 (2000-27703).

The Prior Application 2 (2001-052598) discloses in particular in a paragraph [0025] [see label * ④ inserted for the Examiner's convenience] an electron-emitting device wherein a carbon nanotube is displayed on a lower potential electrode, and a catalyst such as Pd, Ni, Fe, Co and etc. is used to form a carbon nanotube, and an image forming apparatus comprising a plurality of such electron-emitting devices. And, therein, as examples of the carbon nanotube, a single layer nanotube and a multi-layer nanotube are disclosed. Accordingly, claims 21, 22-27 and 30-39 are substantially identical with the invention disclosed in the Prior Application 2 (2001-052598).

Applicant also represents that paragraphs [0041] - [0042] of "Prior Application 1" cited in the Japanese Official Letter, state following:

> [0041] FIG. 9 is a partial side sectional view showing a method of preparing an electron emission source of the third working embodiment of this invention. In FIG. 9, cathode electrode 902 as the first electrode and gate electrode 903 as the second electrode are made to adhere to glass-made insulating substrate 901 by vapor deposition and so on.
>
> [0042] Next, the electron emission source materials produced in the aforementioned first and second working embodiments are made to adhere as emitter 904 on the surface of the upper side of cathode electrode 902 which is situated between the cathode electrode and the gate electrode, thereby producing the electron emission source. It is not, however, objectionable that emitter 904 is made to adhere not on the surface of the upper side of cathode electrode 902 but on the side wall of cathode electrode 902 which is situated between cathode electrode 902 and gate electrode 903.

Also, paragraph [0025] of "Prior Application 1" cited in the Japanese Official Letter, states the following:

> [0025] Drawing 2 shows another example of a configuration of the electron emission component of this invention. In this case, the carbon nanotube is formed in the electrode by the side of low voltage, and the high potential electrode side consists of film, such as a metal or a semi-conductor. In this case, since a gate electrode consists of fields, the more uniform emission characteristic is acquired. In order to realize such a configuration, [whether a carbon nanotube is formed only in one electrode by printing, and]. The approach to which an electrochemistry target is made to adhere by impressing an electrical potential difference to an electrode 21 alternatively. How to form and carry out vapor growth of the catalyst only to one electrode like 41 in drawing. The approach of constituting an electrode 21 from a catalyst, forming an electrode 22 with a non-catalyst nature electrical conducting material, and forming by vapor growth, the approach of carrying out pattern formation of the carbon nanotube film formed beforehand by approaches, such as photolithography, etc. can be illustrated.

Applicant also represents that the Japanese Official Letter states, in a section that has been marked ② for the Examiner's convenience, the following:

Reason 3

The present invention as defined in the claims of the present application can be readily deduced by those skilled in the art in view of the following documents.

Reference 1: JP 09-237565
Reference 2: JP 11-194134
Reference 3: JP 2000-191302

Claims 21 and 23-29 are obvious in the view of the References 1-3.

The Reference 1 discloses in particular, paragraphs [0063] - [0071] and Figs. 9-11 [see label * ⑤ inserted for the Examiner's convenience] a technique of lateral type electron-emitting device wherein an electron-emission member is disposed on an emitter electrode, and a technique of using the electron-emitting devices in a flat panel display.

The Reference 2 (JP 11-194134) discloses an electron emitting device wherein a carbon nanotube formed using a catalyst such as Ni, Fe or Co is disposed and a manufacturing method of the electron emitting-device.

The Reference 3 (JP 2000-191302) discloses that a graphen is stacked as an example of a carbon nanotube.

All of the References 1 and 2 are directed to the electron emitting device. Accordingly, it can be readily deduced by those skilled in the art, to apply the technique of the Reference 2 to the electron-emission member of the Reference 1 constitute the present invention defined in claim 21.

And, claims 23-39 can be readily deduced by those skilled in the art in view of the References 1-3.

Applicant also represents that paragraphs [0063] - [0071] of "Reference 1" cited in the Japanese Official Letter, state the following:

[0063] (Example 2) Drawing 9-11 are drawings showing the production process of the field-electron-emission component of the horizontal spindle of this example. On the quartz substrate (insulating substrate) (91) with a thickness of 1mm, 1-micrometer Si layer (92) was stuck like the example 1, and the silicone carbide film (93) with a thickness of 1 micrometer was formed with the CVD method by the same conditions as a table 2 (drawing 9 (a)). 70 ppm N (nitrogen) was added as an impurity by using NH3 of 0.5sccm(s) as doping gas at the time of formation of this silicone carbide film (93).

[0064] The resist film with a thickness of 3 micrometers was applied on the silicon carbide film (93), the wedge-shaped mask was let pass and developed [exposed and] with lithography, and it left the wedge-shaped resist (94) (drawing 9 (b)).

[0065] Subsequently, Si layer (92) and the silicon carbide layer (93) of a part by the conditions of a table 7 in which a mask is not carried out by RIE were removed by having used the resist (94) of this wedge shape as the mask, and the quartz substrate side (91a) was exposed (drawing 9 (c)).

[0066] Subsequently, the exposed surface (91a) of the quartz which is an insulating substrate (91) was etched with HF (hydrogen fluoride) solution 5% by having used the resist (94) as the mask, it removed in a depth of about 1 micrometer, and a new quartz substrate side (91b) was exposed (drawing 9 (d)).

[0067] Subsequently, by the spatter, after making a tungsten (95a and 95b) with a thickness of 1 micrometer deposit (drawing 10 (e)), the tungsten film (95b) the resist (94) on the silicon carbide film (93) and on it was removed by developing negatives with the developer of a resist (drawing 10 (f)).

[0068] Next, the quartz in the meantime was shaved by etching by having used as the mask the silicon carbide (93) which serve as tungsten film (95a) on the quartz substrate (91b) which should serve as a gate electrode, and an emitter, and the slot (clearance) (91b) was formed. The field-electron-emission component of the horizontal type by which the emitter (93) and the gate electrode (95a) have been arranged through this slot was formed (drawing 11).

[0069] Since the acute section (emitter) which carries out electric-field concentration in the emitter for field-electron-emission components of an example 2 is formed with the single silicon carbide which is excellent in thermal resistance, secure [to the Joule's heat accompanying high current density/sufficient thermal resistance and stability] is clear. Moreover, since the emitter front face which consists of silicon carbide has sufficient resistance and sufficient mechanical reinforcement to oxidation or etching, its long-term stability of the emission current improves.

[0070] The electrical potential difference which silicon carbide degenerates, and a surface electron affinity is set to 3eV or less, and is impressed to a gate electrode since 70 ppm N (donor impurity) is added by the silicon carbide which constitutes an emitter –several 10– it decreases to about -100V.

> [0071] In the emitter of an example 2, since the 70 ppm impurity is added and impurity level is located in the conduction band of silicon carbide, the electronic excitation process between impurity-bands will be controlled and the emission current from an emitter will not change to heat, light, crystal orientation, and a crystal polymorphism. Furthermore, since the forbidden-band width of face (2.2-2.8eV) of silicon carbide is remarkable and wider than the forbidden-band width of face (1.12ev) of silicon, it is the field-electron-emission component which operates to stability also in an elevated temperature 500 degrees C or more.

For the concise statement of relevance of non-English document 09-237565, the Examiner is also respectfully referred to the English abstract and to the English translation of the claims attached thereto.

For the concise statement of relevance of non-English document 11-194134, of record, the Examiner is respectfully referred to the English abstract attached thereto, and to English counterparts U.S. Patent 6,628,053 B1 and EP 0913 508 A2, submitted herewith merely to supply a concise statement of relevance, and EP 0 913 508 A3, of record. Also, attached thereto is the English translation of the claims in the document.

For the concise statement of relevance of non-English document 2000-191302, the Examiner is respectfully referred to the English abstract attached thereto.

For the concise statement of relevance of non-English document 2000-277003, the Examiner is respectfully referred to the attached English Abstract and to English counterpart U.S. Patent Application Publication No. 2002/0136896 A1, submitted herewith merely to supply a concise statement of relevance.

Lastly, for the concise statement of relevance of non-English document 2001-052598, the Examiner is respectfully referred to the English abstract and to English translation of the claims attached thereto.

For each non-English document, the Examiner also is referred to the above representations where relevant.

Each item of information in this information disclosure statement (cited on Form PTO-1449) was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing date of this Statement.

It is respectfully requested that the above information be considered by the Examiner and that a copy of the enclosed Form PTO-1449 be returned indicating that such information has been considered.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

Frank A. DeLucia
Attorney for Applicants
Registration No.: 42,476

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3800
Facsimile: (212) 218-2200

NY_MAIN 458976v1

FORM PTO 1449 (*modified*)

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

LIST OF REFERENCES CITED BY APPLICANT(S)
(Use several sheets if necessary)

ATTY DOCKET NO.	APPLICATION NO.
03500.015727.	09/941,780

APPLICANT: TAKEO TSUKAMOTO

FILING DATE	GROUP
AUGUST 30, 2001	2821

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO/ OR ABSTRACT
		09-237565	09/09/97	JAPAN	H01J	1/30	Abstract
		2000-191302	7/11/00	JAPAN	C01B	3/00	Abstract
		2000-277003	10/6/00	JAPAN	H01J	9/02	Abstract USP 2002/0136896 A1
		2001-052598	2/23/01	JAPAN	H01J	1/316	Abstract

OTHER DOCUMENT(S) (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form #62